

REMARKS

Claims 1-15 are pending in the present application. Claims 1-14 are rejected. Claim 13 is herein amended. Claims 29-32 are added herein.

Claim Rejections under 35 U.S.C. §103

Claims 1-5, 7, 9 and 11 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,629,393 to Summerfelt et al. in view of U.S. Patent No. 6,294,860 to Shimada et al.

The Examiner states that Summerfelt et al. discloses a capacitor comprising a buffer structure 34 formed on a substrate 30 and having a height larger than a width thereof; a lower electrode 36 formed on the buffer structure 34; a capacitor dielectric film 38 formed on the lower electrode, and formed of a perovskite ferroelectric material having a smaller thermal expansion coefficient than that of the buffer structure; and an upper electrode 40 formed on the capacitor dielectric film. The Examiner acknowledges that Summerfelt et al. does not expressly disclose the perovskite ferroelectric material having a crystal oriented substantially perpendicular to a surface of the lower electrode. However, the Examiner states that Shimada et al. discloses a capacitor structure comprising a substrate 10; a buffer layer 11/11A, a lower electrode 12; a perovskite ferroelectric (PZT) material having a crystal oriented substantially perpendicular to a surface of the lower electrode. The Examiner concludes that it would have been obvious to use the PZT crystal orientation teaching of Shimada et al. in place of the device of Summerfelt et al. because it would have provided a high piezoelectric strain constant and good adhesion with a lower electrode which can be produced without being cracked as taught by Shimada et al.

Applicants respectfully disagree with the above rejection, because the cited references, even if combined, do not teach all the limitations of the present claims, as herein amended.

The Examiner notes that Shimada et al. discloses the piezoelectric device including a piezoelectric layer formed of a perovskite ferroelectric material having a crystal oriented substantially perpendicular to a surface of the lower electrode. However, in Shimada et al., the perovskite ferroelectric film is formed by sol-gel method, so that one of ordinary skill in the art would not apply the perovskite ferroelectric film of Shimada et al. to the capacitor of Summerfelt et al.

Applicants note that the sol-gel method is a film-forming method by using spin coating. The spin coating is not preferable for forming the film on the rough surface, although it is preferable for forming the film on the planar surface such as the surface of the lower electrode of Shimada et al. In particular, the capacitor dielectric film requires the strict uniformity, so that the film forming method achieving good step coverage, such as CVD method, is required for forming the capacitor dielectric film on the three-dimensional lower electrode.

Applicants note that Shimada et al. discloses how to form the perovskite ferroelectric film having the crystal oriented substantially perpendicular to the surface of the lower electrode by sol-gel method. However, Shimada et al. neither teaches nor suggests that the perovskite ferroelectric film is formed by CVD method. Sol-gel method and CVD method are significantly different with each other with respect to the film-forming mechanism. Thus, even though the perovskite ferroelectric film having the crystal oriented substantially perpendicular to the surface of the lower electrode can be formed by sol-gel method, it would not become the basis of being able to form the perovskite ferroelectric film having such the crystal orientation by other methods. Additionally, as described in the background section of the present specification, the

method for forming by CVD method the perovskite ferroelectric film having the crystal oriented substantially perpendicular to the surface of the lower electrode formed above the substrate having the thermal expansion coefficient lower than the capacitor dielectric film has not been found.

Therefore, Shimada et al. would not provide any motivation for forming the perovskite ferroelectric film having the crystal oriented substantially perpendicular to the surface of the lower electrode on the lower electrode having three-dimensional structure. It follows that it would not have been obvious to one of ordinary skill in the art to use the PZT crystal orientation teaching of Shimada et al. in place of the device of Summerfelt et al.

Claims 1-12 are rejected under 35 U.S.C. §103(a) as being unpatentable over Summerfelt et al. in view of JP 2000-286396A to Hiyama et al. Claims 13 and 14 are rejected under 35 U.S.C. §103(a) as being unpatentable over Summerfelt et al. in view of Hiyama et al. and U.S. Pub. 2002-0063274 of Kanaya et al.

Applicants respectfully disagree with the above rejection, because there is no suggestion to combine the cited references in the manner suggested to reach the claimed invention.

The Examiner notes that Hiyama et al. discloses the capacitor including a perovskite ferroelectric film 5 having a crystal oriented substantially perpendicular to a surface of the lower electrode. However, in Hiyama et al., like the case of Shimada et al., the perovskite ferroelectric film is formed by sol-gel method. Thus, Hiyama et al. would not have provided any motivation for forming the perovskite ferroelectric film having the crystal oriented substantially perpendicular to the surface of the lower electrode on the lower electrode having three-dimensional structure. Therefore, it would have been unobvious to one of ordinary skill in the

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art to use the PZT crystal orientation teaching of Hiyama et al. in place of the device of Summerfelt et al.

In view of the aforementioned amendments and accompanying remarks, Applicants submit that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP



Kenneth H. Salen

Attorney for Applicants
Registration No. 43,077

KHS/led
1250 Connecticut Avenue, NW
Suite 700
Washington, D.C. 20036
(202) 822-1100

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